PHILIPPINE GREEN BUILDING CODE

Engr. RHONNIEL CARINGAL

August 6, 2016

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

Outline:

I. Effect of buildings' energy consumption to global warming and climate change

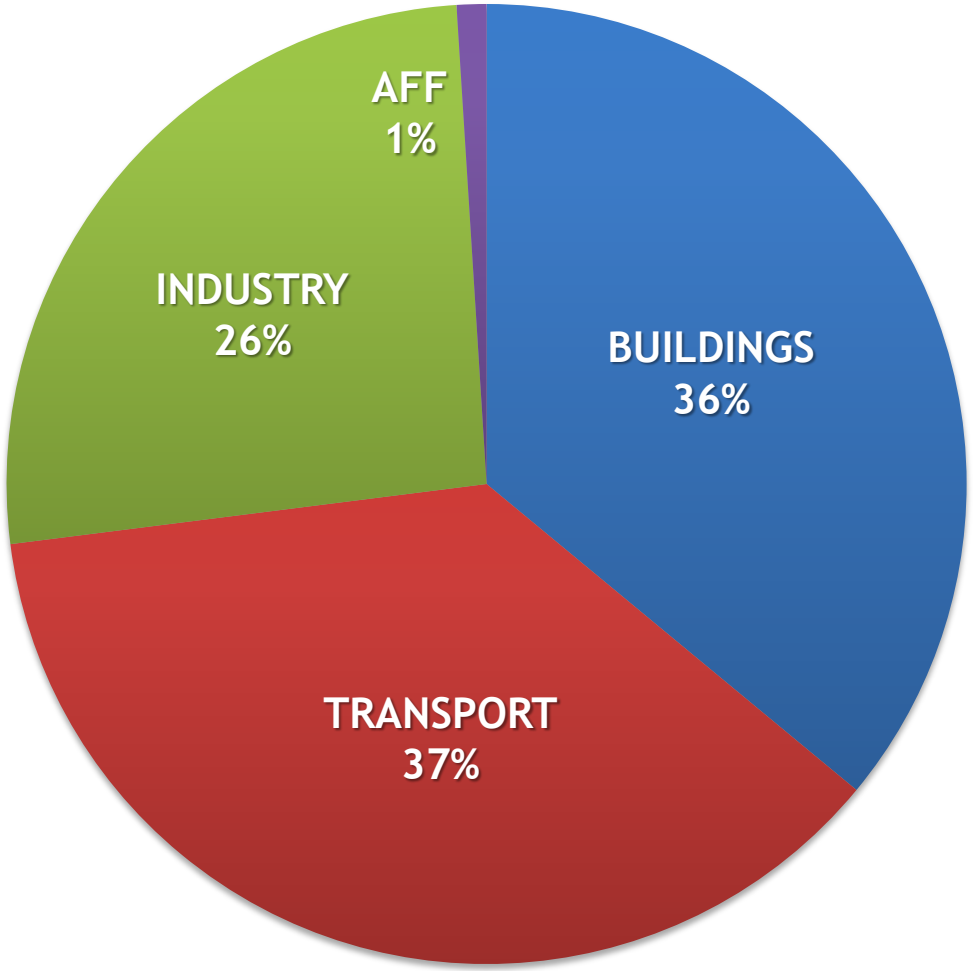
II. What green buildings are and how these address the issues

III. Process of choosing the Green Building technologies

IV. Performance Standards included in the new Philippine Green Building Code

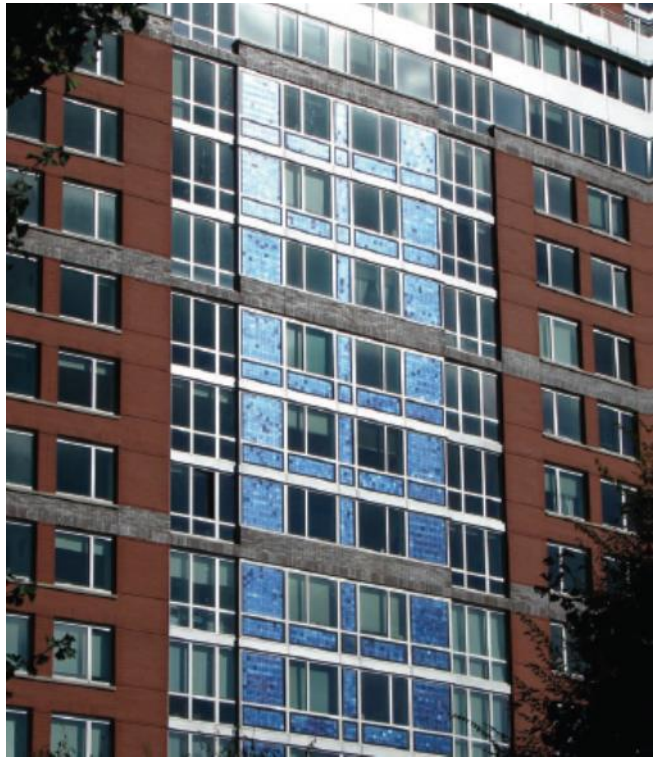
2010 ENERGY CONSUMPTION BY SECTOR

Buildings account for 36% of the national energy consumption



Current local scenario

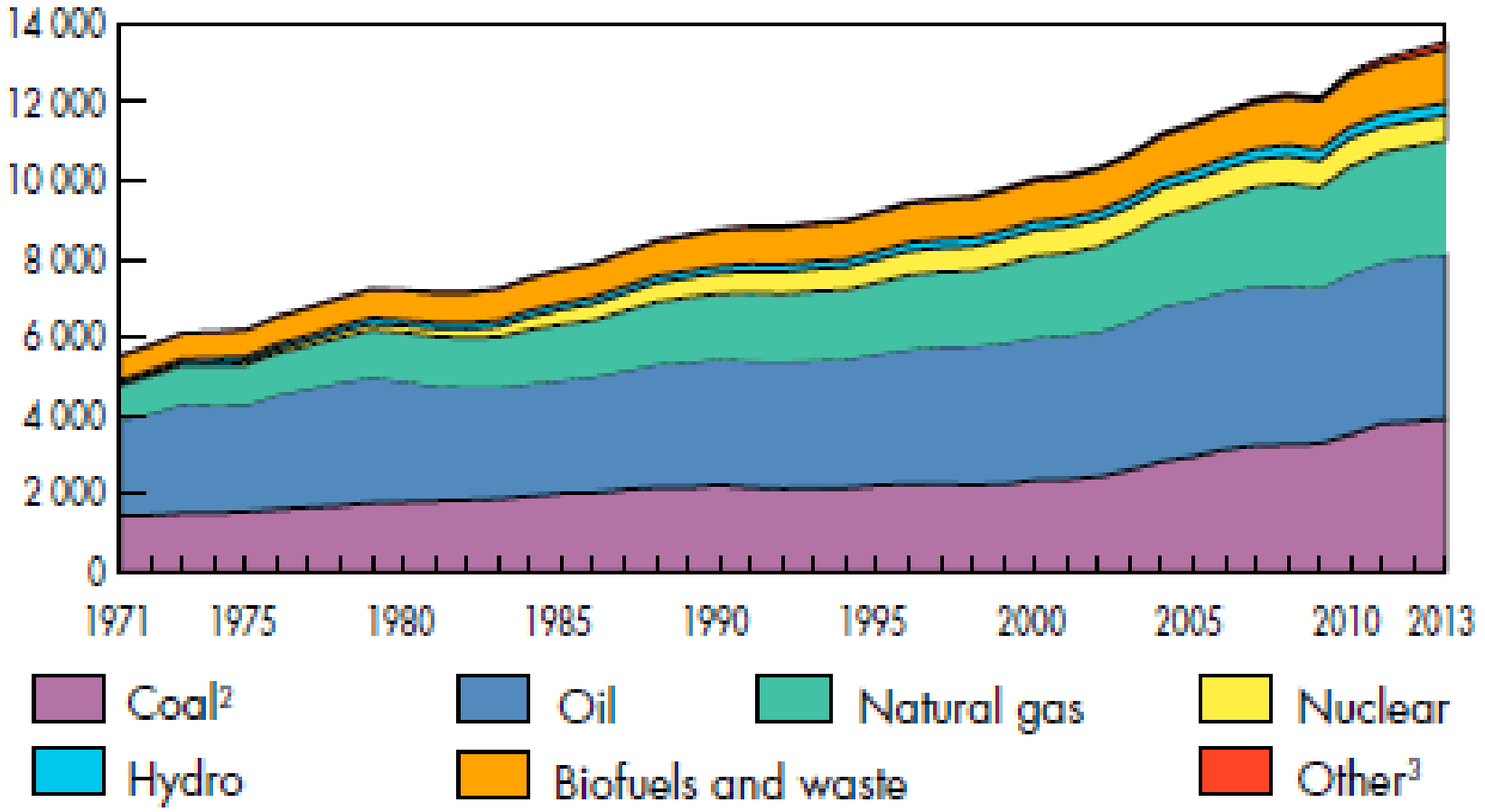
- High annual growth rate of **8% -9%** in the past yrs. due to growing urbanization & high demand for space



TOTAL PRIMARY ENERGY SUPPLY

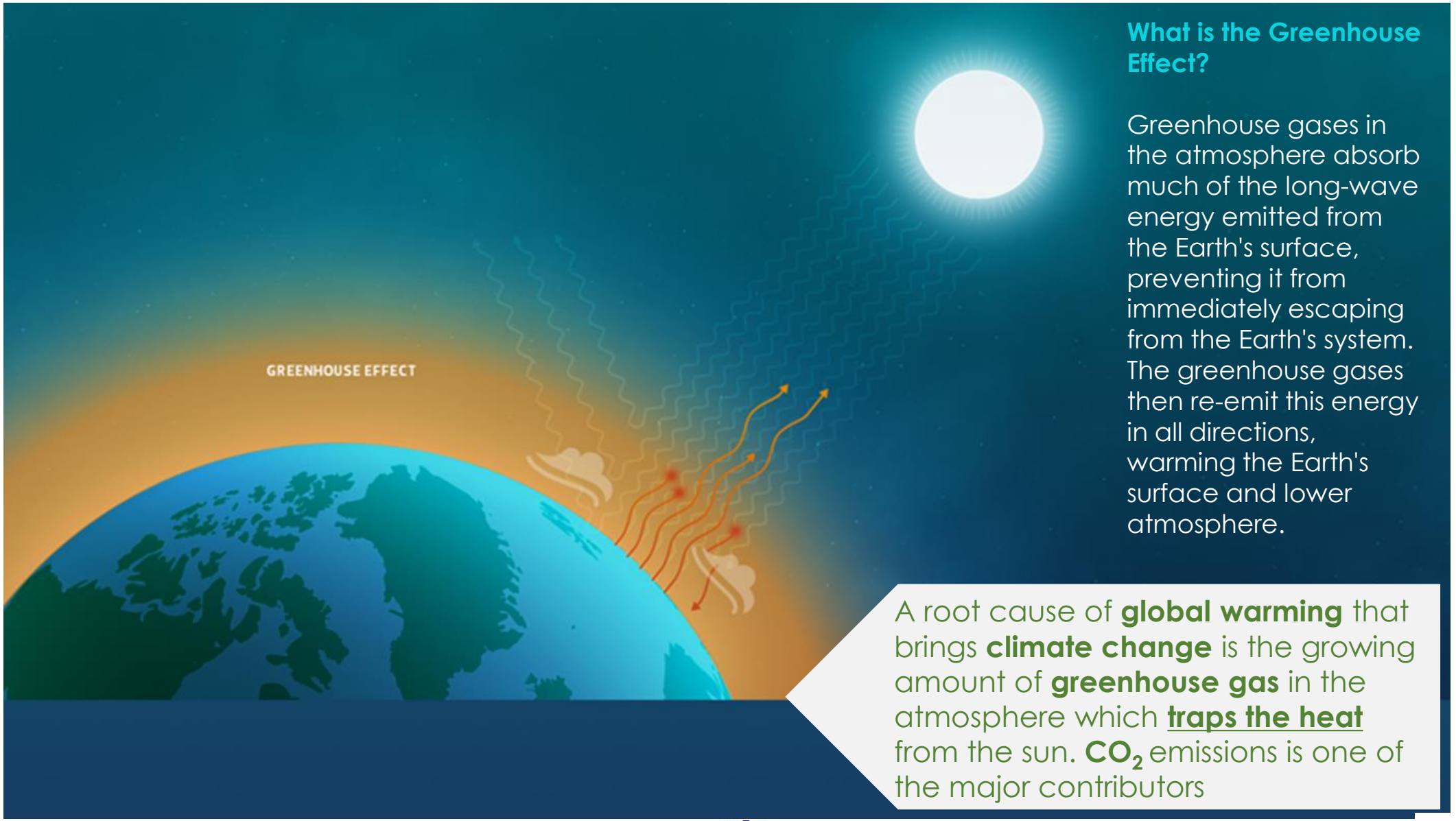
World

World[1] total primary energy supply (TPES) from 1971 to 2013 by fuel (Mtoe)



Philippine Green Building Code

CO_2 emissions is prevalent in fossil-fuel burning, like in fossil fuel-fired power plants. Coal fired, natural gas and oil-fired power plants are predominantly the ones supplying energy to the grid, for the electricity demands of buildings.



What is the Greenhouse Effect?

Greenhouse gases in the atmosphere absorb much of the long-wave energy emitted from the Earth's surface, preventing it from immediately escaping from the Earth's system. The greenhouse gases then re-emit this energy in all directions, warming the Earth's surface and lower atmosphere.

A root cause of **global warming** that brings **climate change** is the growing amount of **greenhouse gas** in the atmosphere which **traps the heat** from the sun. **CO_2** emissions is one of the major contributors

According to the World Meteorological Organization (WMO), there was a **32%** warming of the world's climate mainly due to carbon dioxide.

Carbon dioxide emission, which is **80%** cause of the warming, is largely due to fossil fuel emissions.

Erratic, extreme weather conditions

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

RA 9729 - "Climate Change Act of 2009"

AN ACT MAINSTREAMING CLIMATE CHANGE INTO GOVERNMENT POLICY FORMULATIONS, ESTABLISHING THE FRAMEWORK STRATEGY AND PROGRAM ON CLIMATE CHANGE, CREATING FOR THIS PURPOSE THE CLIMATE CHANGE COMMISSION, AND FOR OTHER PURPOSES

As a party to the United Nations Framework Convention on Climate Change, the State adopts the ultimate objective of the Convention which is **the stabilization of greenhouse gas concentrations…**

- SECTION 2 RA 9729

…the State has adopted the Philippine Agenda 21 framework which espouses **sustainable development**, to fulfil human needs while maintaining the quality of the natural environment for current and future generations.

- SECTION 2 RA 9729

Green Building

practice of increasing efficiency with which buildings use resources such as energy, water and materials

while also reducing the buildings' impact on human health and the environment

Green Buildings – are the product of sustainable design.

A green/sustainable design is a design that minimizes the negative human impacts on the natural surroundings, materials, resources and processes that prevail in nature

- ASHRAE GREENGUIDE

We need GREEN BUILDINGS:

Promote resource management efficiency and site sustainability while minimizing negative impact of buildings on health and environment

SOLUTION: reduce demand + lower carbon dioxide emission

Benefits

- Lower business costs
- Increase value of property
- Conserve resources
- Improve air quality
- Improve occupant health and productivity
- Save the planet

PHILIPPINE GREEN BUILDING CODE

THE PROJECT...

1. Aims at reducing GHG emission and improving water and energy efficiency; and

2. Partners with Mandaluyong City to pilot green building regulations and DPWH to adopt Green Building Referral Code.

Objectives of GB Code:

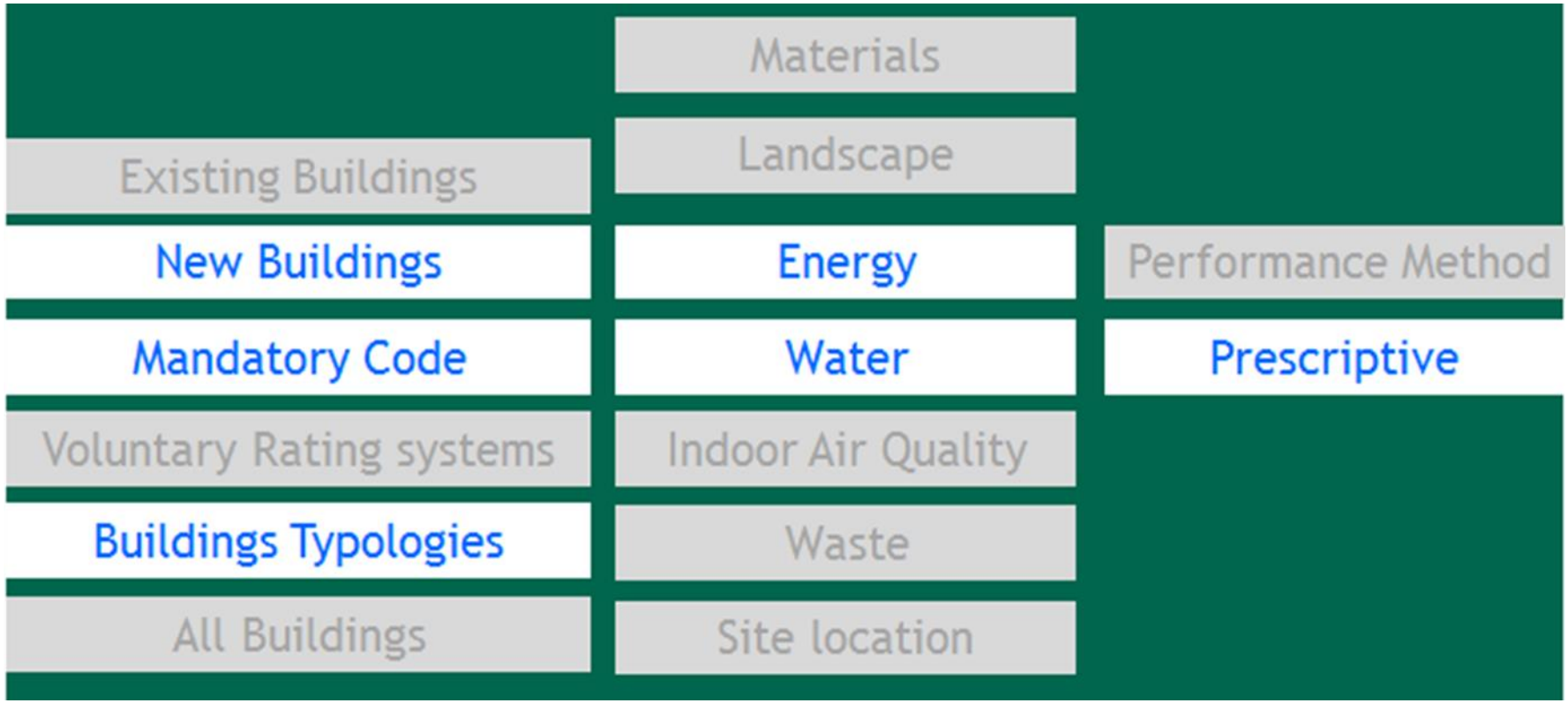
1. Improve efficiency of building performance through set of standards
2. Counter harmful gases responsible for effects of climate change
3. Efficient use of resources, site, design, construction, maintenance

...without significant increase in cost.

Targets:

POTENTIAL IMPACT (2030)	
USD 864 Million	Costs expected to be avoided
1.87 Million Metric tons	Reduction in CO2e emissions
3.9 Million KWH	Energy use avoided

Scope:

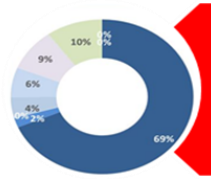

Materials
Landscape
Existing Buildings
New Buildings
Energy
Performance Method
Mandatory Code
Water
Prescriptive
Voluntary Rating systems
Indoor Air Quality
Buildings Typologies
Waste
All Buildings
Site location

Methodology:

Building Trends & Baselines

Market Analysis

Sensitivity Analysis



Green Building Recommendations

BASELINES

Basis

Baselines:

6 Typologies

- Hotel
- Office
- Retail
- Hospital
- Educational Institutions
- Residential Condominiums

5 years

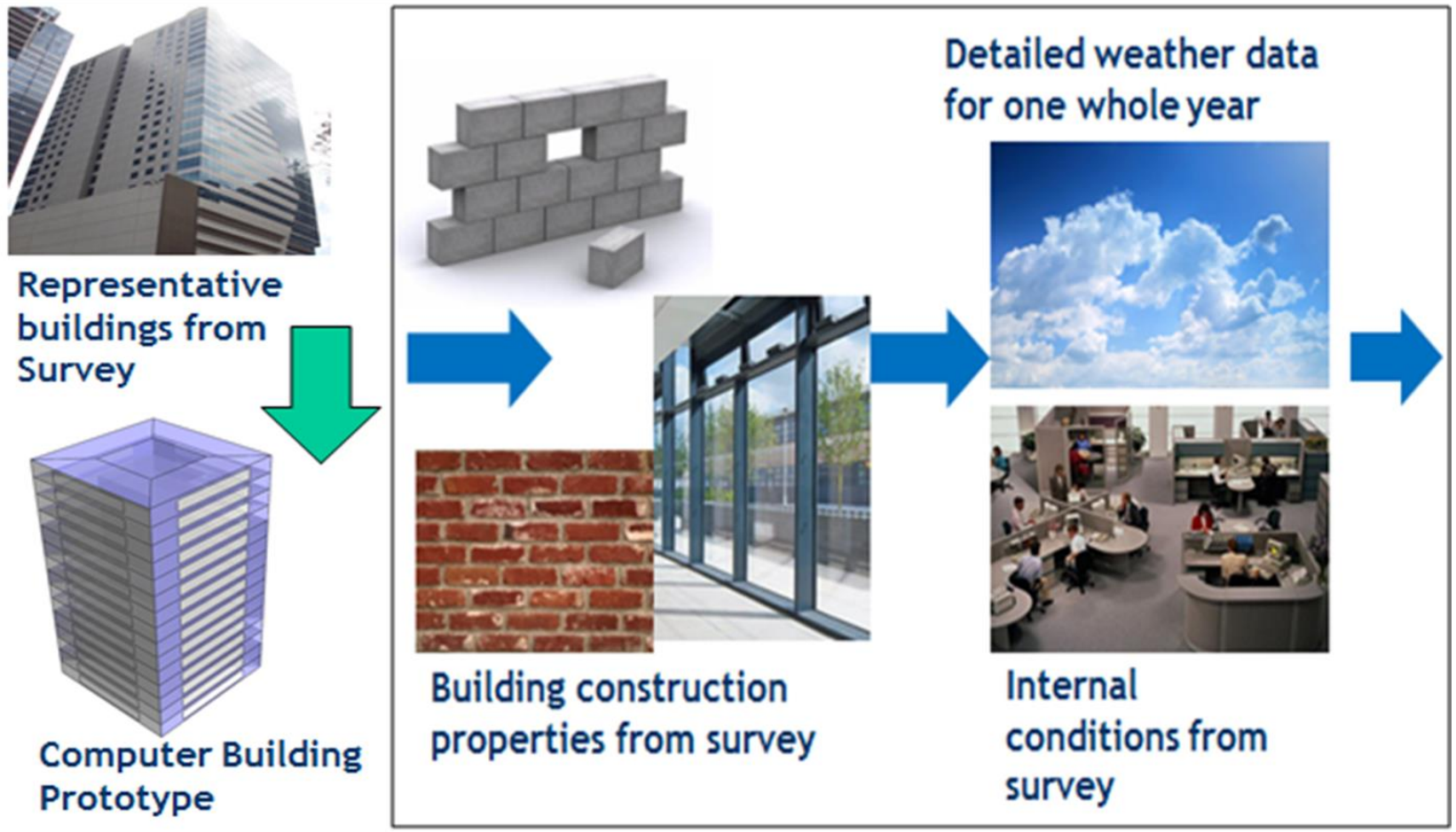
>5000 gfa

Metro Manila
Metro Cebu
Metro Davao

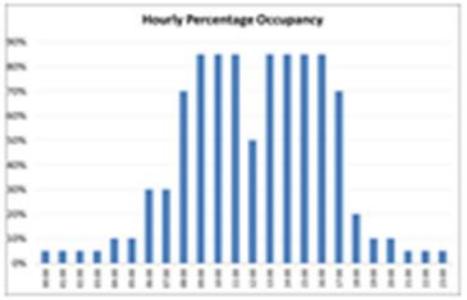
Baselines:

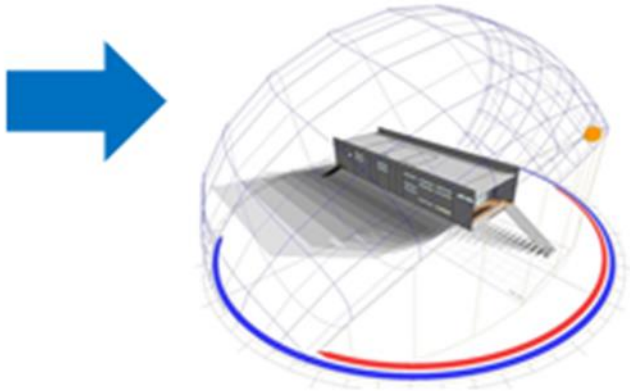
- New buildings (average 5 years from completion)
- Total GFA of 800,000sqm
- Average occupancy of 84%
- More than 40,000 full time occupancy
- Average 15 floors
- Internal set points on 24°C
- 95% un-insulated walls
- 97% with single glazing
- 43% with no air conditioning or room air conditioning systems
- 224kWh/m^2 of energy usage

Baselines:

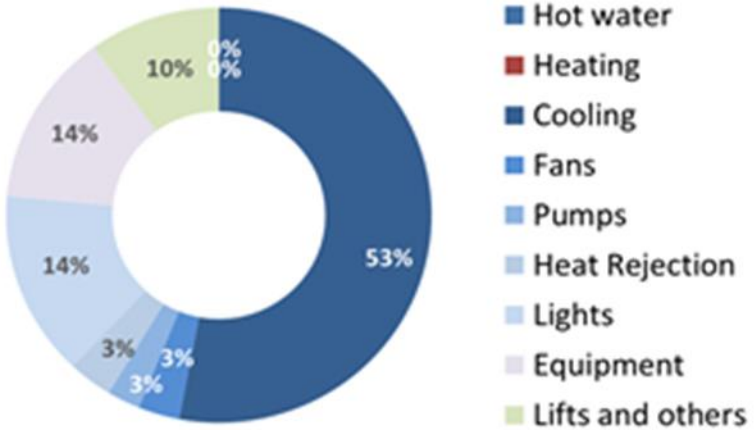

Representative buildings from Survey
Computer Building Prototype
Detailed weather data for one whole year
Building construction properties from survey
Internal conditions from survey

Defining Baselines:



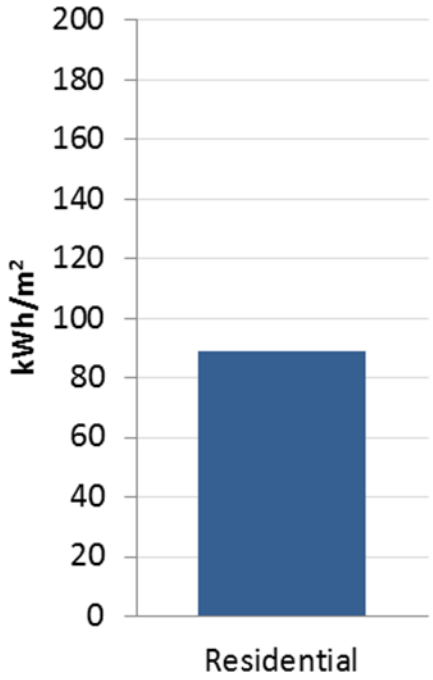


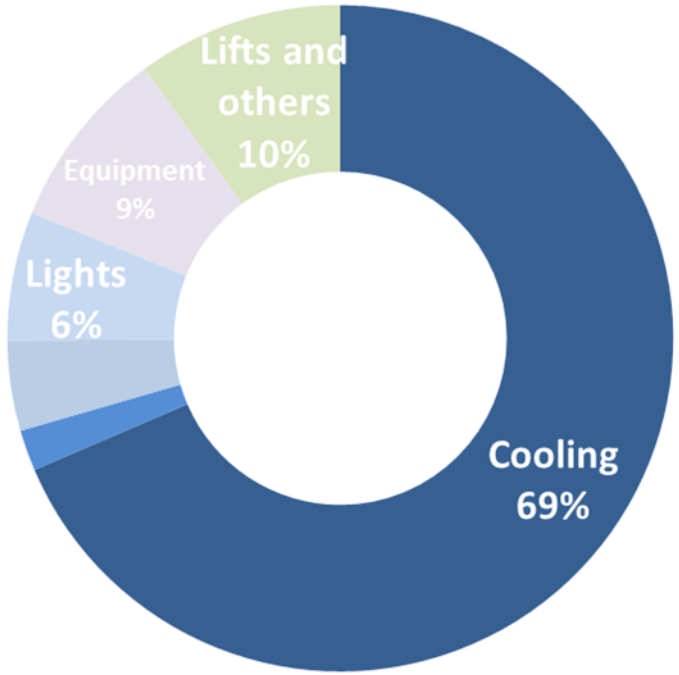
Hourly data for a typical year



Typical Energy Breakdown

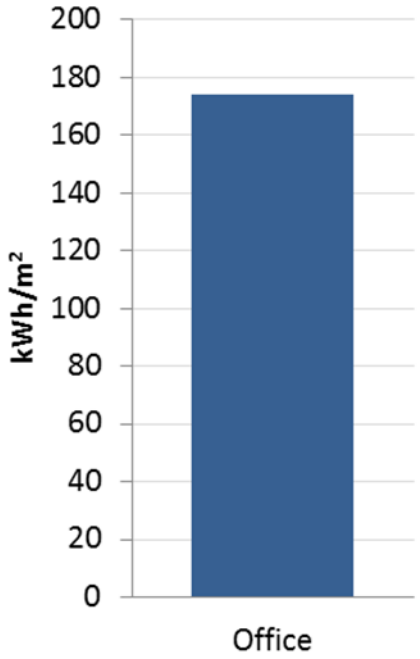
Baseline Energy Consumption for Residential - Manila

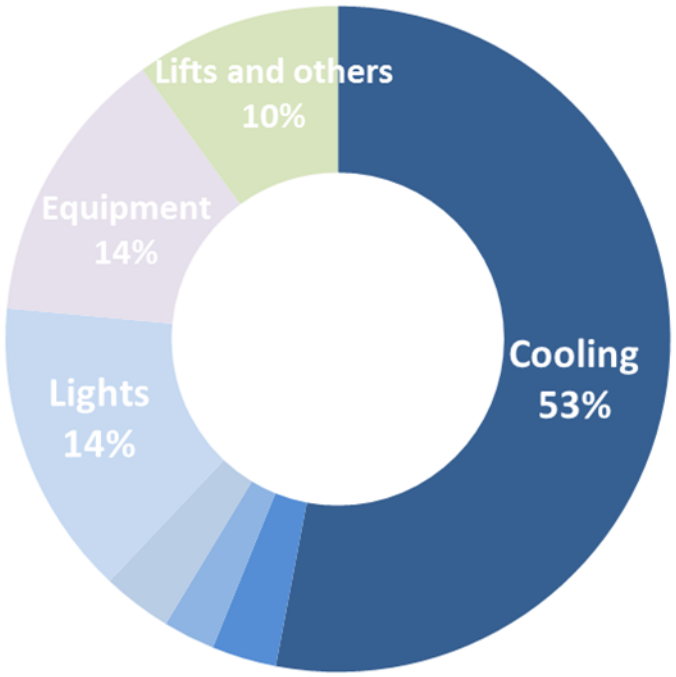




- Hot water
- Heating
- Cooling
- Fans
- Pumps
- Heat Rejection
- Lights
- Equipment
- Lifts and others

Baseline Energy Consumption for Office - Manila





- Hot water
- Heating
- Cooling
- Fans
- Pumps
- Heat Rejection
- Lights
- Equipment
- Lifts and others

Sensitivity Analysis

Air conditioning	Envelope	Lighting	Other
Air tightness	Window To wall ratio	High efficiency lighting	Lift & Escalator efficiencies
Type of cooling system	Overhangs	Light Power Density	Commissioning
Cooling set-point	Fins	Daylight control	
Humidity control	Glazing U-value	Occupancy sensors	
Chiller efficiency	Glazing SHGC		
Variable flow for chillers	Roof U-value		
Pipework and ducts insulation	Wall U-value		
Fresh air	Wall thermal mass		
CO2 sensors for fresh air	Building Thermal Mass		
Ventilation efficiency	Roof reflectivity		
Variable speed drive	Wall reflectivity		
Automatic timer for cooling systems	Thermal bridging		
VSD for chillers			
Sensible Heat recovery			
Enthalpy recovery			
Chilled water temperature			
Natural ventilation			
Solar hot water			
Ceiling fans			

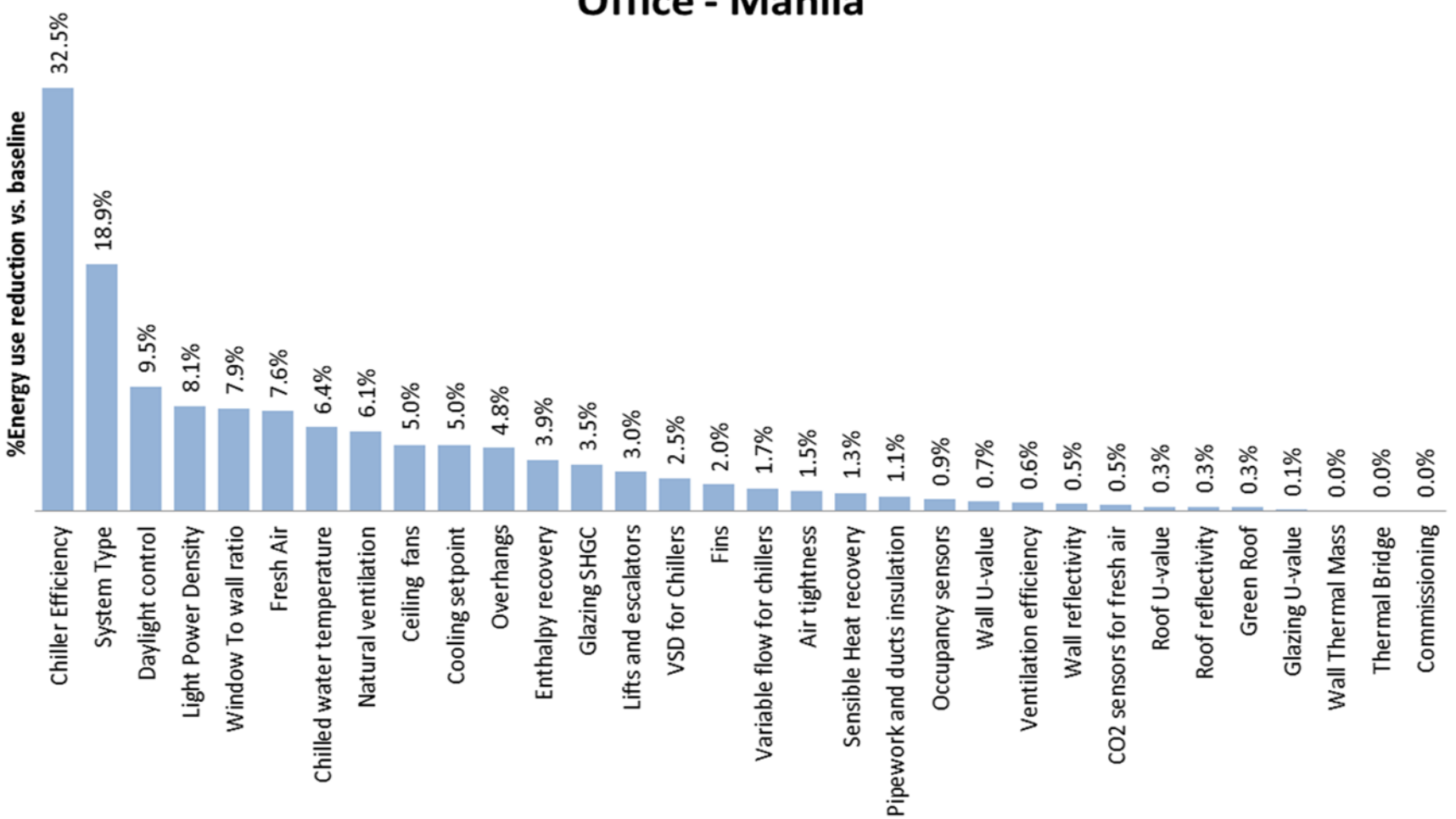
19 HVAC Measures
12 Envelope Measures
6 Power use measures

More than **400** simulations

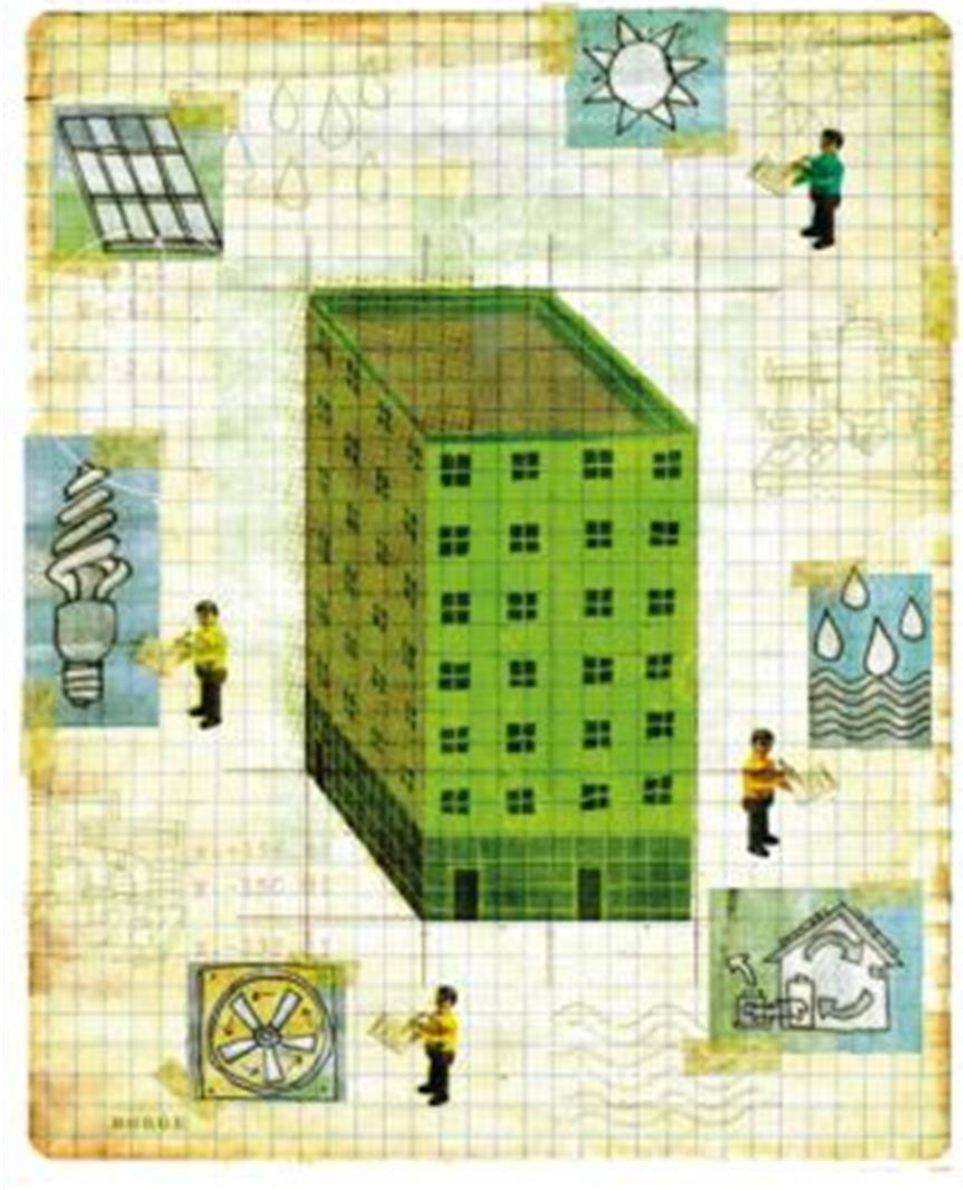
IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

Maximum Savings Potential



How?



International Finance Corporation
WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

Measures Criteria

- High impact
- Short payback period
- Simple and easy to achieve
- Feasible in the Philippines
- Accessible in the region

ENERGY EFFICIENCY
WATER EFFICIENCY
MATERIALS SUSTAINABILITY
INDOOR ENVIRONMENTAL QUALITY
SOLID WASTE MANAGEMENT
SITE SUSTAINABILITY

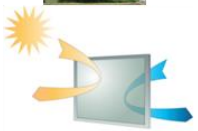
GB REGULATION
ORDINANCE 535 S-2014
(6 Feb 2014)

IRR
(12 Mar 2014)

GB Referral Code
Consultation process

Top Energy Saving Measures

– for the Philippines

	Office	Hospital	School	Residential	Retail	Hotel
 Window to Wall Ratio	8%	3%	7%	7%	4%	5%
 External Shading	5%	2%	6%	6%	3%	3%
 Glass Performance	4%	2%	6%	6%	2%	2%
 Natural Ventilation	6%	8%	5%	9%	12%	4%
 Efficient Chillers	32%	32%	39%	45%	28%	24%
 Total Energy Recovery	4%	11%	N/A	N/A	2%	3%
 Lighting Power Density	8%	6%	13%	4%	23%	7%

Additional Saving Measures

– for the Philippines

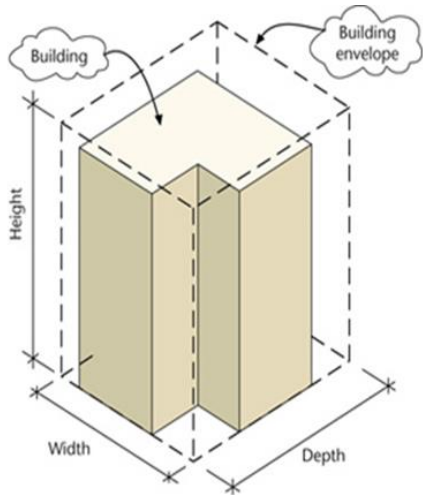
	Office	Hospital	School	Residential	Retail	Hotel
 Daylight Control	10%	N/A	3%	1%	6%	1%
 Occupancy Sensors	1%	N/A	1%	1%	2%	1%
 Lifts and Escalator	1%	2%	N/A	0.3%	2%	2%
 Ceiling Fans	5%	5%	9%	9%	8%	3%
 CO2 sensors	2%	0.3%	N/A	N/A	2%	2%
 VSD for Chillers	2%	19%	N/A	N/A	4%	5%

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

PERFORMANCE STANDARDS

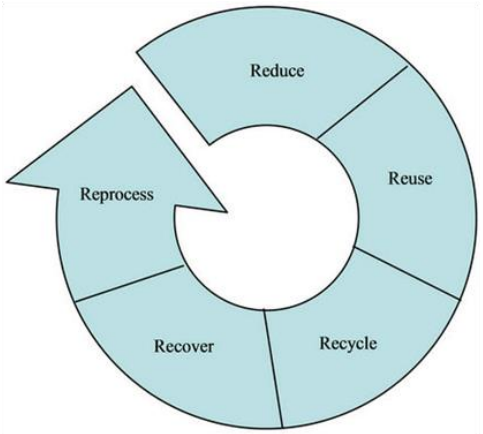
- Energy Efficiency
- Water Efficiency
- Material Sustainability
- Solid Waste Management
- Site Sustainability
- Indoor Environmental Quality



1. Energy Efficiency

2. Water Efficiency

3. Material Sustainability



4. Solid Waste Management

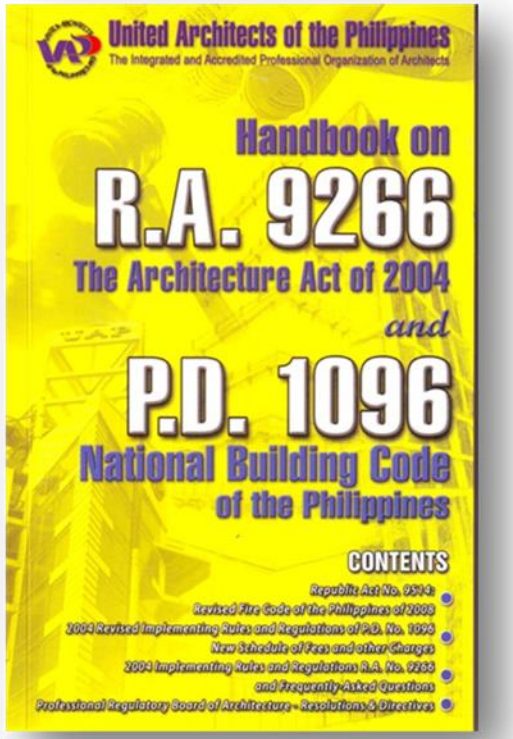
5. Site Sustainability

6. Indoor Environmental Qlty

IFC International Finance Corporation WORLD BANK GROUP

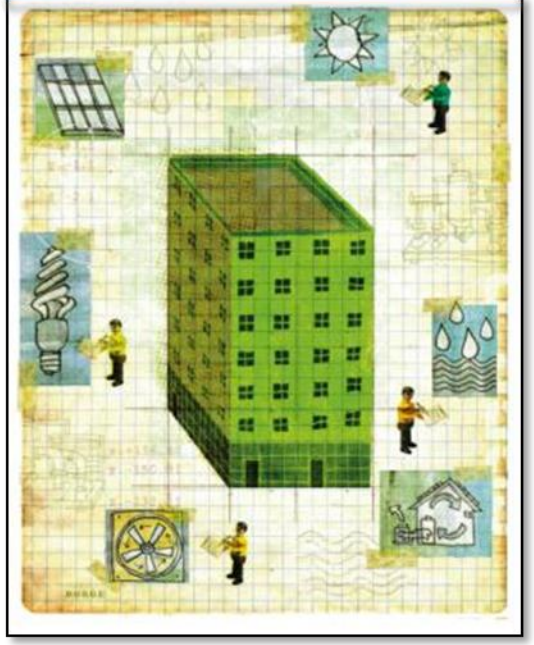
PHILIPPINE GREEN BUILDING INITIATIVE

green



NATIONAL BUILDING CODE

GREEN BUILDING REFERRAL CODE



Coverage and Application

Minimum **Total Gross Floor Area** (TGFA) coverage

USE / OCCUPANCY	TGFA
Hotel	10,000 sqm
Mall	15,000 sqm
Office	10,000 sqm
Residential Condominium	20,000 sqm
School	10,000 sqm
Hospital	10,000 sqm
Mixed Occupancy	10,000 sqm

GB Code is for **new construction** only

Applicable to additions, alterations, conversion or renovations with TGFA as stated in the table

Mixed use – if more than one (1) building use.

1. ENERGY EFFICIENCY

is the adoption of efficient practices, designs, methods and technologies with the goal of reducing energy consumption that will result in savings without compromising safety, health and product quality

1. ENERGY EFFICIENCY

a. Building Envelope
b. Natural Ventilation
c. Building Envelope Color
d. Roof Insulation
e. Efficiency of Mechanical systems
f. Efficiency of Electrical systems

1. ENERGY EFFICIENCY

a. Building Envelope

…encompasses the entire exterior surface of a building, including **walls**, **doors**, and **windows**, which enclose, or envelop, the interior spaces.

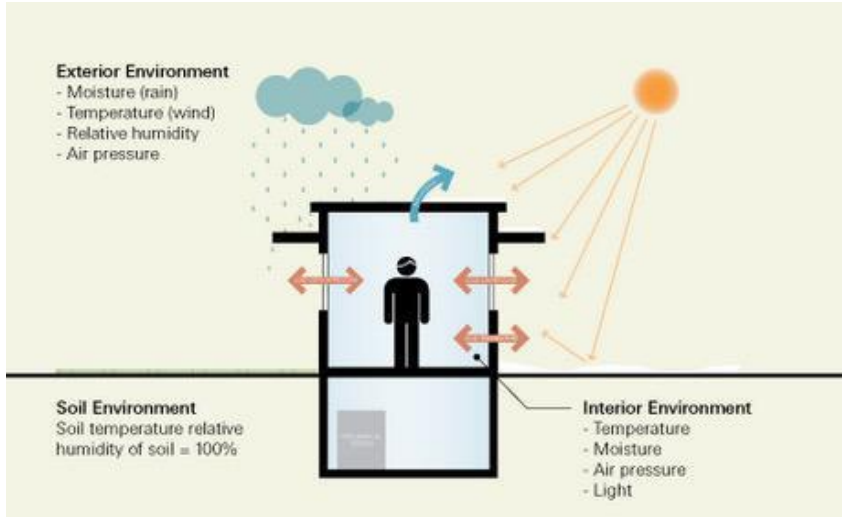
Components:
- roof
- walls
- floor
- fenestrations

1. ENERGY EFFICIENCY

a. Building Envelope

I. **Air Tightness and Moisture Protection**

- reducing air infiltration and exfiltration
- preventing outside air moisture infiltration
- installation of vapor barriers (flashings)



ii **Glass Requirements / Properties**

- Solar Heat Gain Coefficient (SHGC) and WWR

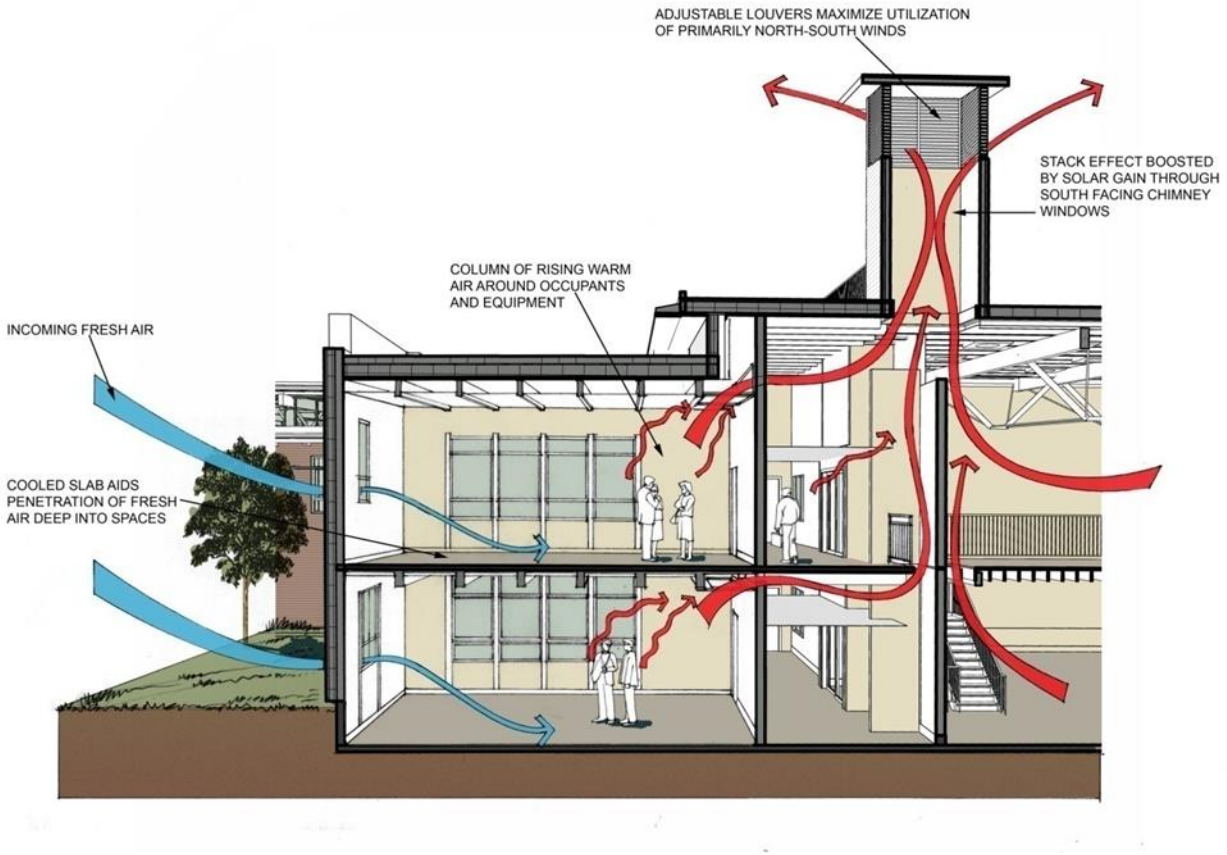
WWR	Maximum SHGC	Minimum VLT
10	0.80	0.80
20	0.70	0.70
30	0.60	0.70
40	0.45	0.60
50	0.44	0.55
60	0.37	0.50
70	0.31	0.45
80	0.27	0.40
90	0.24	0.35

$$\text{Window-to-Wall Ratio} = \frac{\text{[Net Glazing Area] (total window area including frames)}}{\text{[Gross Wall Area] (width of total wall area x height from ground floor to bottom of roof eaves)}}$$

1. ENERGY EFFICIENCY

b. Natural Ventilation

- Use of operable windows; opening shall be equal to at least 10% of floor area



FIXED WINDOW	AWNING WINDOW	SLIDING WINDOW	ALTAIR LOUVRE WINDOWS
0% fresh air	12% - 30% fresh air depending on wind direction	40% maximum fresh air	90% fresh air regardless of wind direction

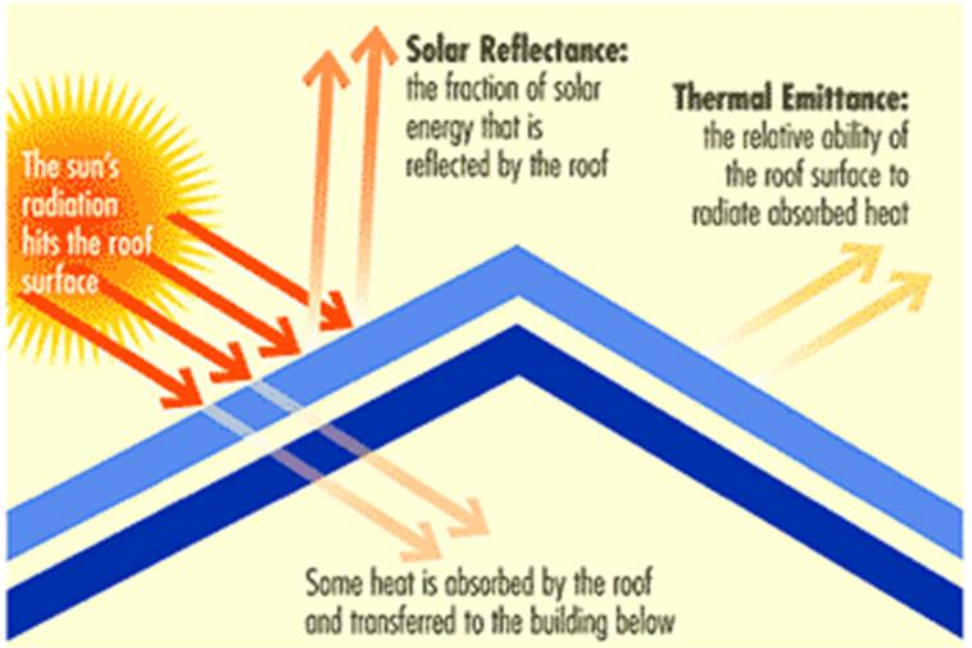
1. ENERGY EFFICIENCY

c. Building Envelope Color

- High solar reflectance index (SRI) of building envelope surface can reduce heat transfer from the outside to the inside

METAL SURFACE	SRI
Reflective white	86 to 92
Basic white	80 to 88
Beige / Tan	74 to 80
Dark brown	0 to 33
Light to medium brown	45 to 56
Light to medium grey	39 to 63
Dark grey	0 to 41
Blue	23 to 30
Light to medium blue	35 to 38
Red	28 to 36
Terracotta red	38 to 40
Green	25 to 32
Light to medium green	30 to 48

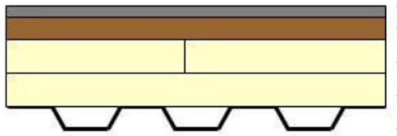
Source: PPG Cool Color Series - www.coolcolorsdatabase.ppg.com
as rated by the Cool Roof Rating Council, US



1. ENERGY EFFICIENCY

d. Roof insulation

- Reduction of heat transfer at the roof through proper insulation thus improving thermal comfort, acouostic quality and load reduction for air conditioning system



Component	R-Value
← Single-Ply Membrane	0.24
← 1" Wood Fiber Cover Board	2.78
← 1.5" Polyiso Foam Board[1]	9.00
← 1.5" Polyiso Foam Board[1]	9.00
← Exposed Steel Deck	Negl.
Total	21.22

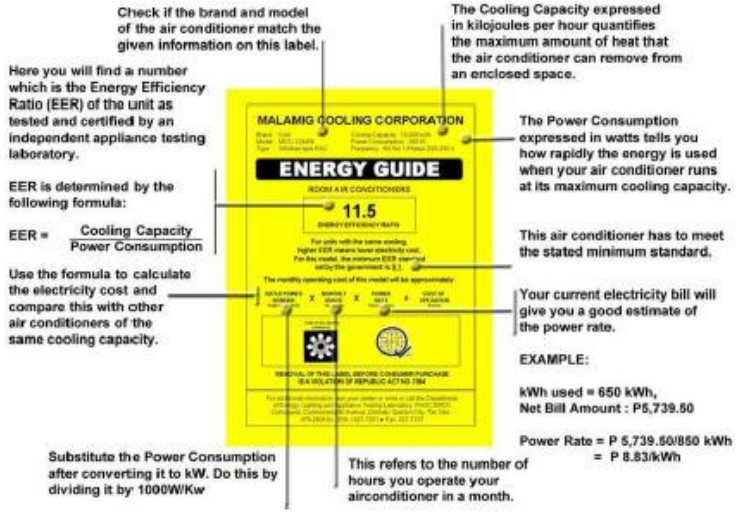
INSULATION	R-Value / inch (25.4 mm)
Polyisocyanurate	5.6 to 8.0
Polyurethane	5.6 to 6.5
Closed cell spray foam	5.5 to 6.0
Phenolic foam	4.8
Urea formaldehyde foam	4.6
Plastic fiber	4.3
Mineral fiber	4.2 to 4.5
Cementitious foam	3.9
Polystyrene	3.8 to 5.0
Fiberglass	3.7
Rockwool	3.7
Rigid foam	3.6 to 6.7
Cellulose	3.6 to 3.8
Open cell spray foam	3.6
Sheep's wool	3.5
Hemp	3.5
Cotton	3.4
Loose cellulose	3.0 to 3.7
Mineral wool	2.8 to 3.7
Straw	2.4 to 3.0
Vermiculite / Perlite	2.4
Reflective bubble foil	1 to 1.1

1. ENERGY EFFICIENCY

e. Efficiency of Mechanical Systems

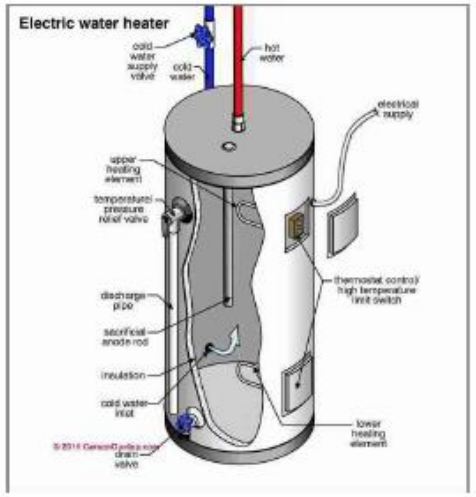
i. **Efficiency of Air-conditioning Equipment**

- use of higher EER



ii. **Energy Efficient Water Heating System**

- observation of minimum performance requirements



IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

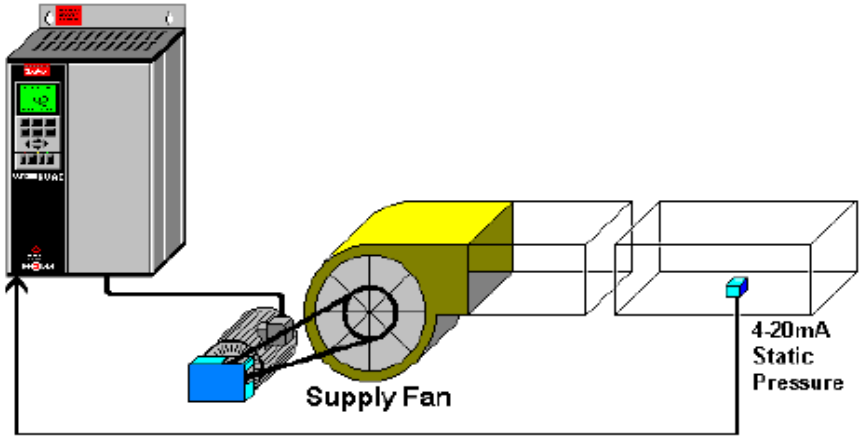
green

1. ENERGY EFFICIENCY

e. Efficiency of Mechanical Systems

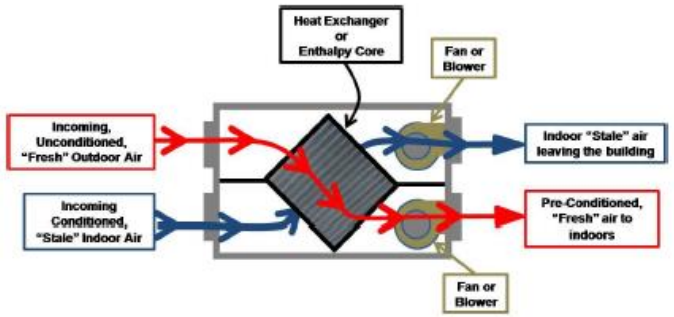
iii. **Variable Speed Drives and High Efficiency Motors**

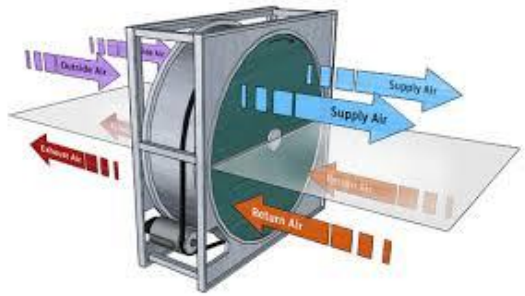
- devices that control speed of machine by adjusting frequency of motor to match actual demand



iv. **Enthalpy Recovery of Exhaust Air**

- recovering energy from the building exhaust air stream to pre-condition fresh air intake



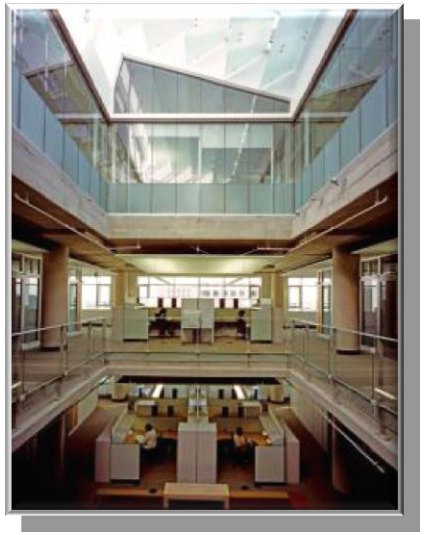


1. ENERGY EFFICIENCY

f. Efficiency of Electrical Systems

i. **Daylighting Provision**

- Harvest natural daylighting through use of windows, light shelf, clerestory, skylight and light scoop



ii. **Daylight Controlled Lighting System**

- Controlled use of artificial lighting due to daylighting

1. ENERGY EFFICIENCY

f. Efficiency of Electrical Systems

iii. **Lighting Power Density**

- Regulated power consumption due to lighting; lower watts per sq. meter

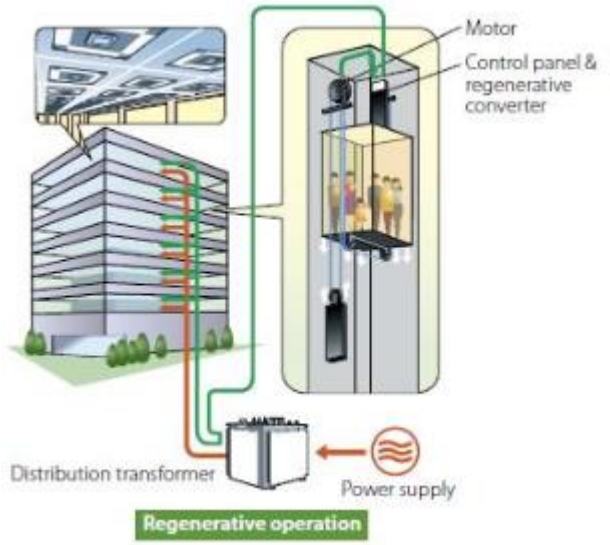
iv. **Occupancy Sensors**

- Controlled use of artificial lighting in areas wth variable occupancy

Building Type	Building Average LPD (W/m^2)
Residential Dwelling: Condominium	10.8
Hotel / Resort	10.8
Educational: School	12.9
Institutional: Hospital	12.9
Business: Office	10.8
Mercantile: Mall	16.1 (excluding accent lighting)

1. ENERGY EFFICIENCY

f. Efficiency of Electrical Systems



v. **Lifts & Escalators Efficiency**

- Use of energy-efficient conveyance control systems (with motion sensors)

vi. **Transformers**

- Use of highly-efficient transformers, > 98%

vii. **Overhead or Elevated Water Storage**

- Water distribution system that utilize reduced pump requirements

2. WATER EFFICIENCY

is the adoption of efficient water-use practices, designs, method and technologies with the goal of reducing water consumption that will result in savings

2. WATER EFFICIENCY

a. Efficient Water Fixtures
b. Water Management

2. WATER EFFICIENCY

a. Efficient Water Fixtures

are technologies that use less water in order to perform the same function of cleaning as effectively as standard models

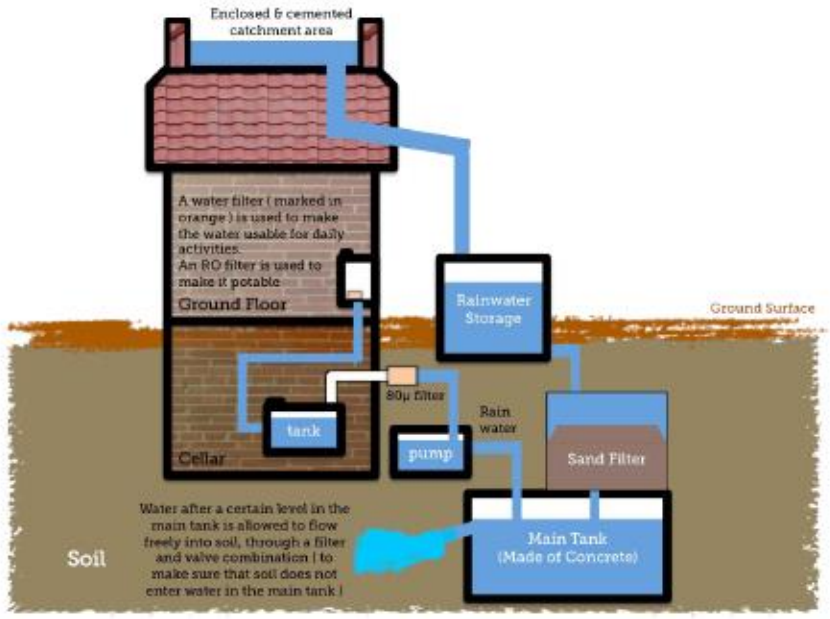
Type of Fixtures	Maximum Flow Rate	
Dual Flush Water Closet	≤6 full 3 low	liters/flushing cycle
Single Flush Water Closet	4.9	liters/flushing cycle
Shower	≤9 (80PSi)	liters/min at 551.6 kPa
Urinals	≤1	liters/flushing cycle
Lavatory taps	≤4.8 (60PSi)	liters/min at 417.7 kPa
Kitchen faucets	≤4.8 (60PSi)	liters/min at 417.7 kPa
Handheld bidet sprays	≤4.8 (60PSi)	liters/min at 417.7 kPa

2. WATER EFFICIENCY

b. Water Management

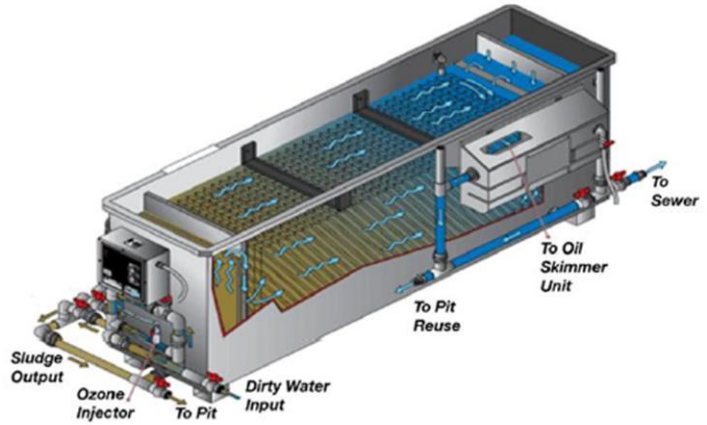
i. Rainwater Harvesting

is the process of collecting rainwater from roof and hardscapes thereby reducing use of potable water



ii. Water Recycling

Resulting water from sewage treatment plants (STP), toilet flushing, cooling towers can be re-used for non-potable purposes



3. MATERIAL SUSTAINABILITY

is the **adoption of products** that require less use of natural resources and less energy/fuel requirements and at the same time, increase the reusability of such materials and products for the same or similar purpose, thereby providing least impact on environment

3. MATERIAL SUSTAINABILITY

Non-toxic Materials

- refer to building materials that does not contain hazardous or toxic chemicals that could cause Sick Building Syndrome (SBS) and eventually lead to Building Related Illness (BRI)

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

3. MATERIAL SUSTAINABILITY

Use of non-toxic materials required under the section on Low-emitting Materials, including the following (from ASHRAE 189.1) :

- Adhesives and sealants
- Paints, coatings, and primers
- Floor coverings
- Composite wood
- Office furniture systems
- Ceiling and wall partitions

Application / Product Type	Maximum VOC Limit (g/L less water)
Flat paint	50
Non-flat paint	150
Anti-rust paint	250
Lacquer (clear wood finish)	550
Sanding Sealer (clear wood finish)	350
Varnish (clear wood finish)	350
Floor coating	100
Shellac (clear)	730
Shellac (pigmented)	550
Stain	250
Faux Finish Coating	350
Architectural sealant	250
Non-membrane roof sealant	300
Single ply roof membrane	450
Waterproofing sealer	250

Application / Product Type	Maximum VOC Limit (g/L less water)
Waterproofing sealer (concrete)	400
Waterproofing sealer (masonry)	400
All other sealers	200
Indoor adhesive	50
Wood flooring adhesive	100
Subfloor adhesive	50
Ceramic tile adhesive	65
Contact adhesive	80
Drywall panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Special purpose contact adhesive	250
PVC welding	510
Concrete curing compound	350
Wood preservative	350

VOC = Volatile Organic Compound

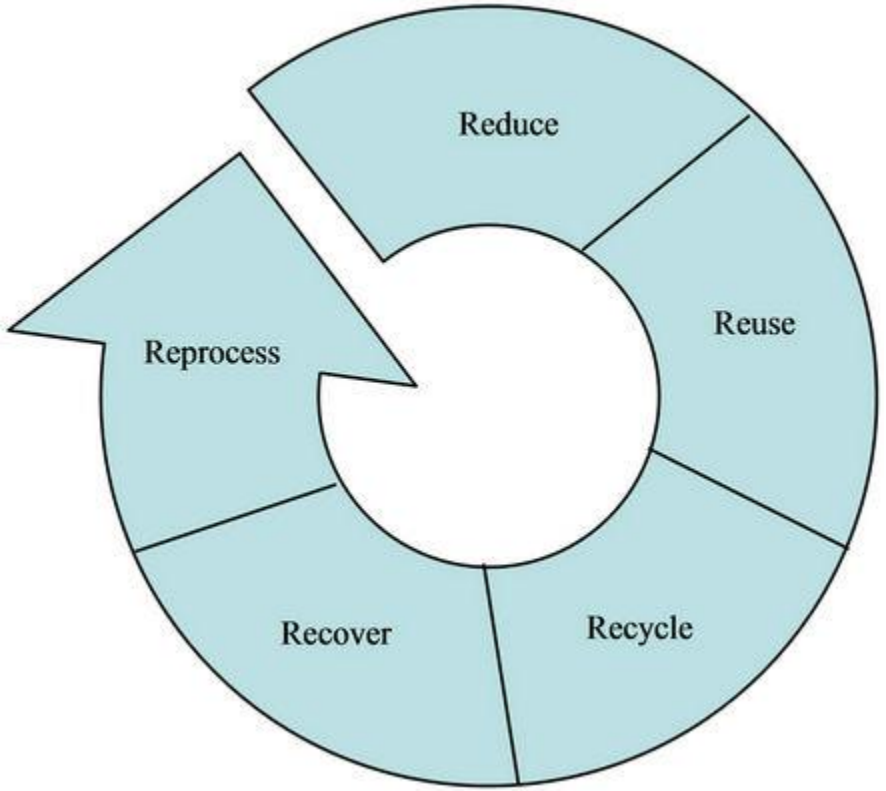
4. SOLID WASTE MANAGEMENT

Efficient waste management & use of eco-friendly materials; supports the principles of RA 9003 or the Solid Waste Management Act

4. SOLID WASTE MANAGEMENT

The new 5 R's cycle approach:

a. Reduce
b. Reuse
c. Recycle
d. Recover
e. Reprocess



4. SOLID WASTE MANAGEMENT

Material recovery facility (MRF)

- is a solid waste management facility that provides for the extraction from solid waste of recyclable materials suitable for use as a fuel or soil amendment or combination; establishment (Hotels, condos, schools, hospitals, etc.) shall provide with a minimum area for MRF

Use / Occupancy	Requirement
Residential Dwelling: Condominium	1.0 sqm waste storage space per 2,500 sqm TGFA + 50% circulation space
Hotel / Resort	1.0 sqm waste storage space per 2,500 sqm TGFA + 50% circulation space
Educational: School	1.0 sqm waste storage space per 300 sqm TGFA + 50% circulation space
Institutional: Hospital	1.0 sqm waste storage space per 1,250 sqm TGFA + 50% circulation space
Business: Office	1.0 sqm waste storage space per 1,400 sqm TGFA + 50% circulation space
Mercantile: Mall	1.0 sqm waste storage space per 400 sqm TGFA + 50% circulation space

4. SOLID WASTE MANAGEMENT

Solid waste containers shall be provided for at least four (4) types of wastes:

a. compostable (biodegradable)
b. non-recyclable (to be disposed off in the landfill)
c. recyclable (paper, cardboard, plastic, metal, wood, etc.)
d. special waste

5. SITE SUSTAINABILITY

Requires the adoption of planning, design, construction & operation practices that minimize negative impact of buildings on ecosystems and water resources

5. SITE SUSTAINABILITY

a. Site / ground preparation and earthworks to reduce
b. Open space utilization

5. SITE SUSTAINABILITY

Site Preparation & Earthworks

Site clearing, grading and excavation shall be planned at the start of construction to mitigate pollution caused by erosion and sedimentation taking into consideration existing endemic foliage as regulated by the DENR

5. SITE SUSTAINABILITY

Open Space Utilization

The inclusion of green or landscaped areas for indigenous or adaptable species of grass, shrubs and trees will help in providing more permeable surface for the building development's open space and thus allow the re-charging of natural ground water reservoir, control storm water surface run-off, cool the building surroundings, and provide indoor to outdoor connectivity for the building occupants.;
50% of the required unpaved surface area (USA) shall be vegetated

6. INDOOR ENVIRONMENTAL QUALITY

Requires adoption of efficient design & operation practices that considers building environment to improve occupant health, productivity and safety

6. INDOOR ENVIRONMENTAL QUALITY

a. Minimum fresh air rates
b. Designated Smoking areas

6. INDOOR ENVIRONMENTAL QUALITY, (IEQ)

Minimum Fresh Air Rates

Maintaining good indoor air quality thru the constant replacement of indoor air in buildings

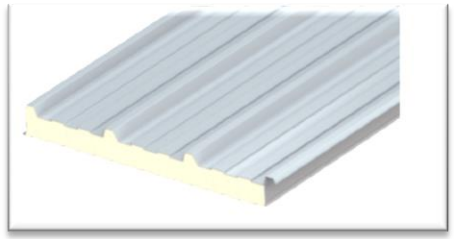
Designated Smoking Area

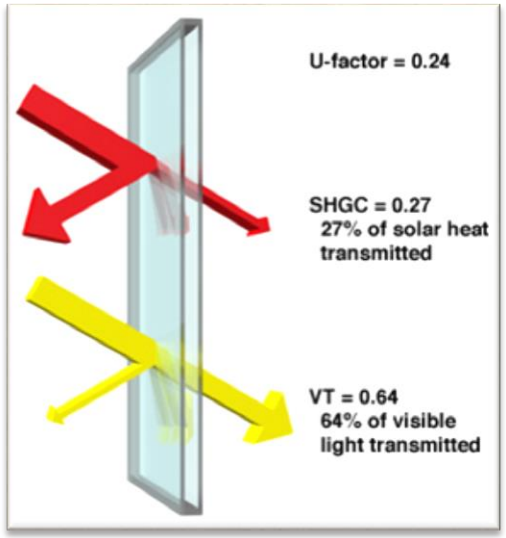
Restricting tobacco smoke to specified areas to maintain good indoor air quality

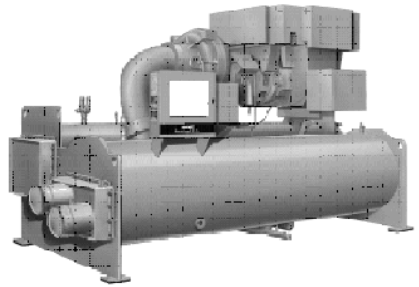
Occupancy Category	People Outdoor Air Rate		Area Outdoor Air Rate		Max. Default Occupancy Density
	(cfm / person)	(cmh / person)	(cfm / sq ft)	(cmh / sq.m)	(people / 1,000 sq ft (90 sq m))
General					
Conference / meeting	5	8.5	0.06	0.1968	50
Corridors	-		0.06	0.1968	-
Storage Rooms	-		1.12	3.6736	-
Break room	5	8.5	0.06	0.1968	25
Coffee room	5	8.5	0.06	0.1968	20
Disco / dance floors	20	34	0.06	0.1968	100
Health club (aerobics room)	20	34	0.06	0.1968	40
Health club (weights room)	20	34	0.06	0.1968	10
Bowling gallery (seating)	10	17	0.12	0.3936	40
Gambling casino	7.5	12.75	0.18	0.5904	120
Game arcades	7.5	12.75	0.18	0.5904	20
Stages, Studios	10	17	0.06	0.1968	70
Public Assembly Spaces					
Auditorium seating areas	5	8.5	0.06	0.1968	150
Places of religious worship	5	8.5	0.06	0.1968	120
Courtrooms	5	8.5	0.06	3.6736	70
Legislative chambers	5	8.5	0.06	0.1968	50
Libraries	5	8.5	0.12	0.1968	10
Lobbies	5	8.5	0.06	0.1968	150
Museums (children's)	7.5	12.75	0.12	0.1968	40
Museums / galleries	7.5	12.75	0.06	0.1968	40

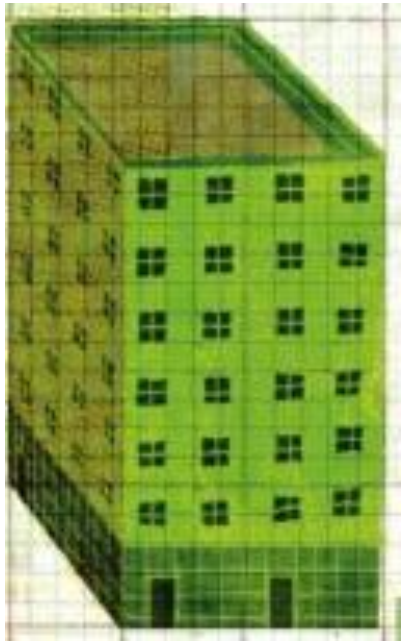
POTENTIAL

20-25% Energy Savings
Water Savings









BUILDING PERMIT PROCESS

GREEN BLDG CERTIFICATE IN DESIGN

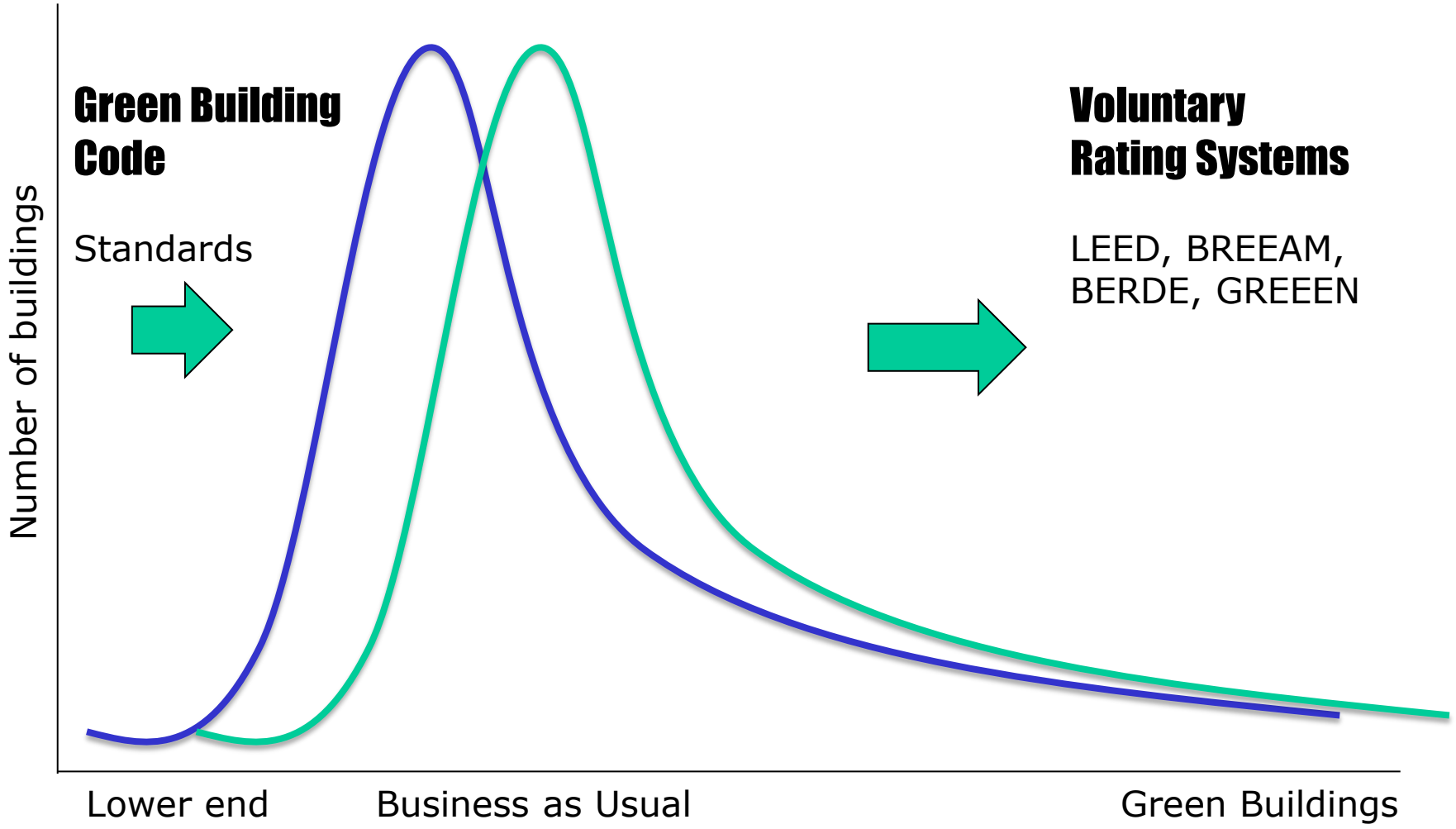
BUILDING PERMIT

GREEN BLDG CERTIFICATE IN CONSTRUCTION

CERTIFICATE OF OCUPANCY

International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE



International Finance Corporation
WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

DPWH STATUS

Mar 2014
- Stakeholder Consultations

Apr 2014
- Approval Process

Jun 2015
- Launching

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE

IFC International Finance Corporation WORLD BANK GROUP

PHILIPPINE GREEN BUILDING INITIATIVE